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(52) UK CL (Edition P)
H4L LDPP L1H10

(56) Documents Cited
EP 0813332 A1 EP 0647055 A1 WO 95/20298 A1
US 5400395 A US 5109401 A

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INT CL[6] H04M 15/28, H04Q 7/22 7/32
ONLINE: WPI

(54) Abstract Title
Call Charge Notification for a mobile Subscriber

(57) Call charging rate and current billing balance data is received from the communications network at the mobile subscriber unit. A timer accumulates time elapsed since the start of the call and using the rate data calculates and displays the updated billing data during the call.

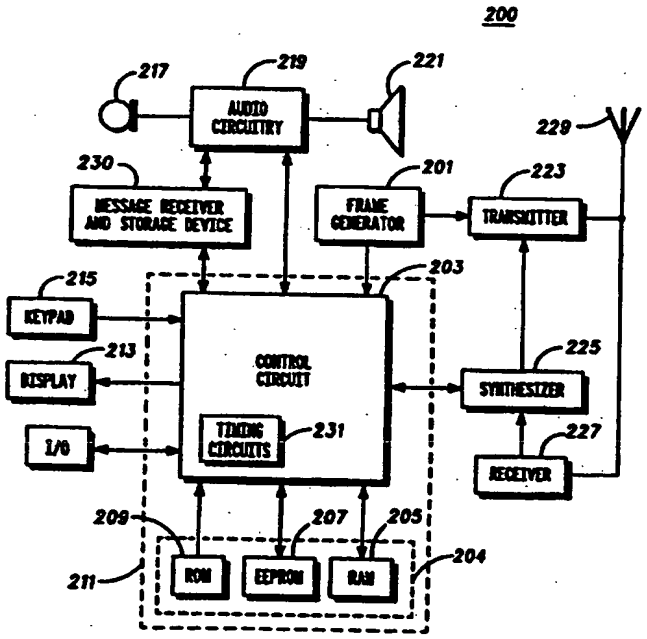

FIG.2

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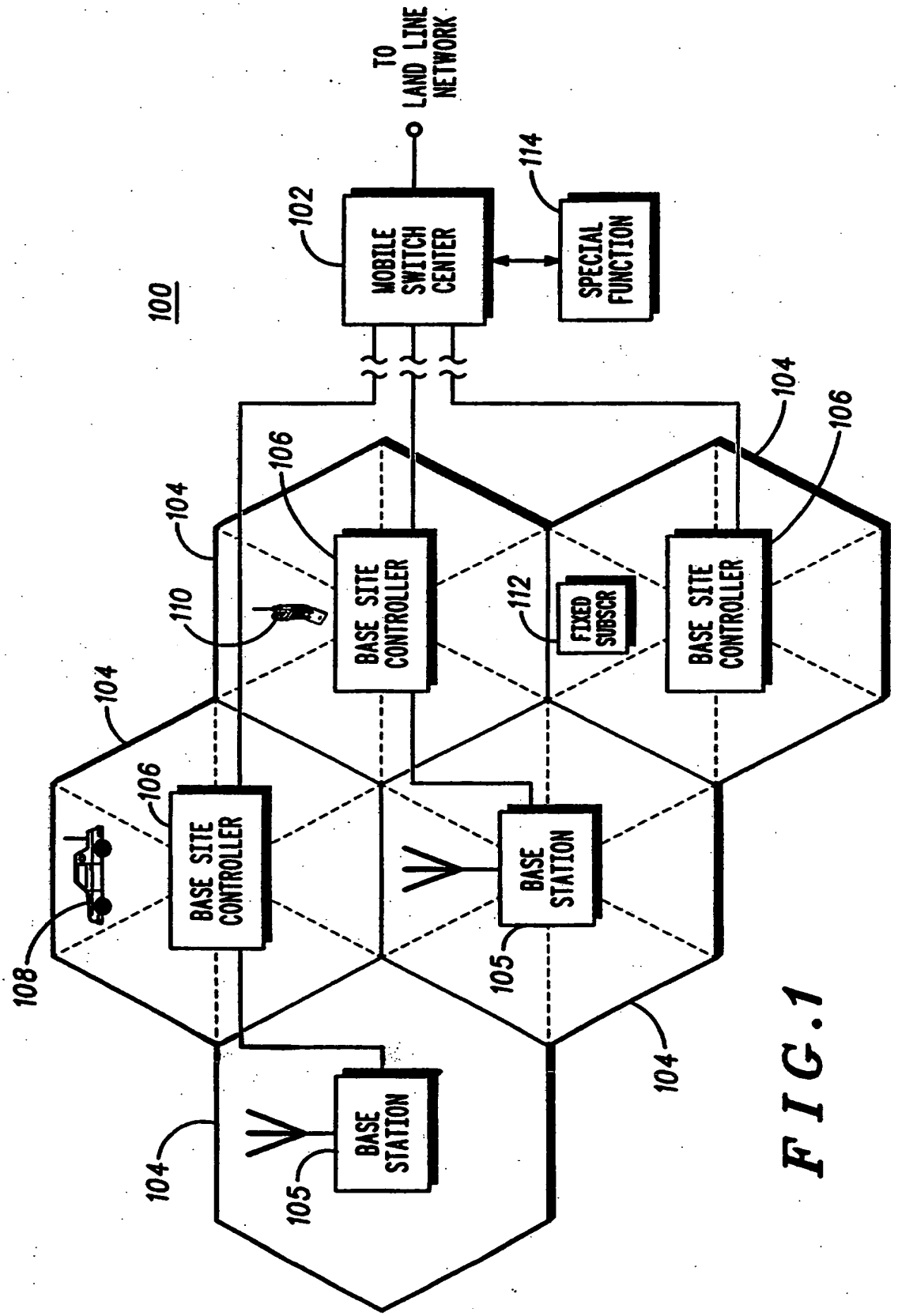


FIG.1

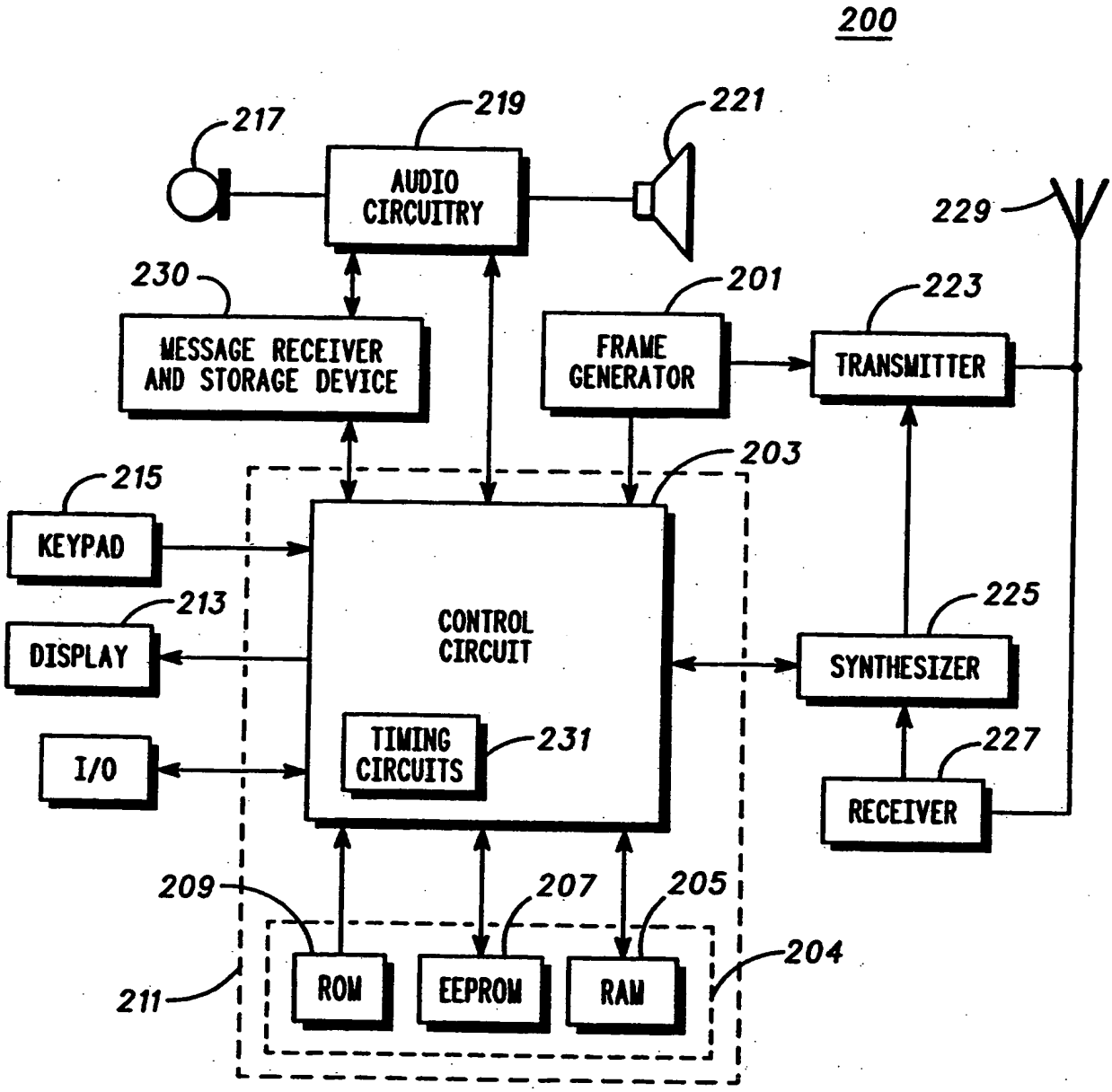


FIG.2

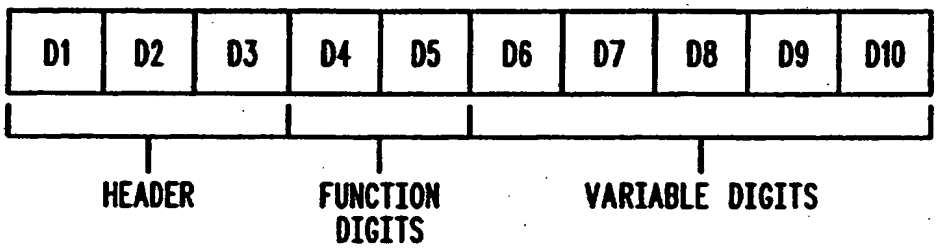


FIG. 3A

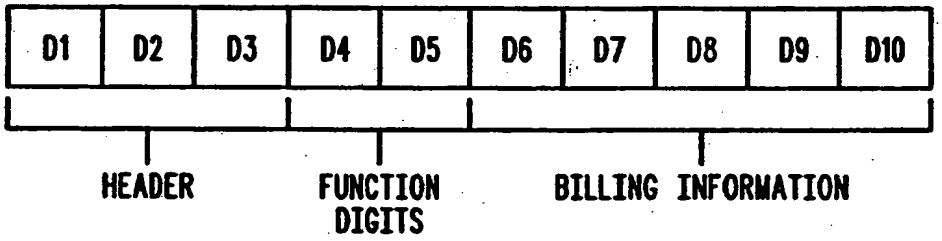


FIG. 3B

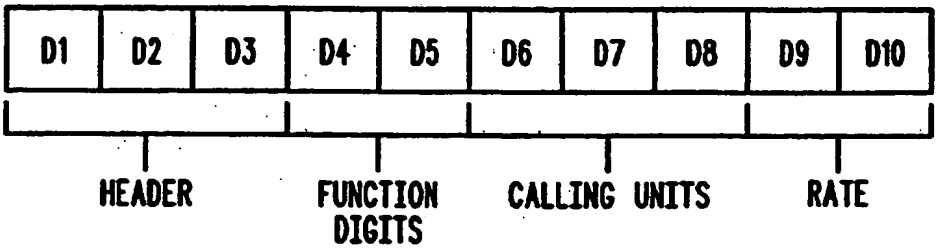


FIG. 3C

FIG.4

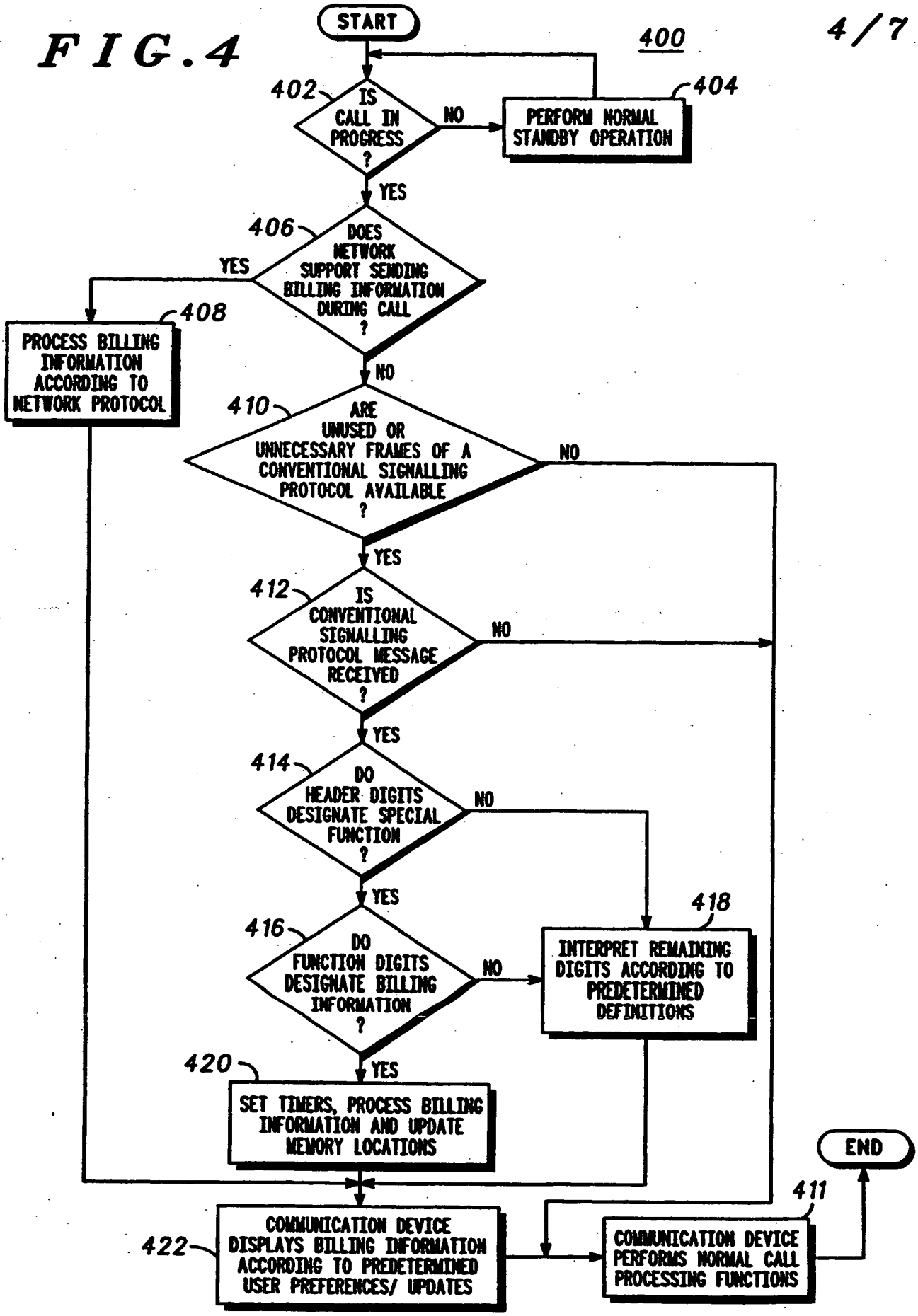
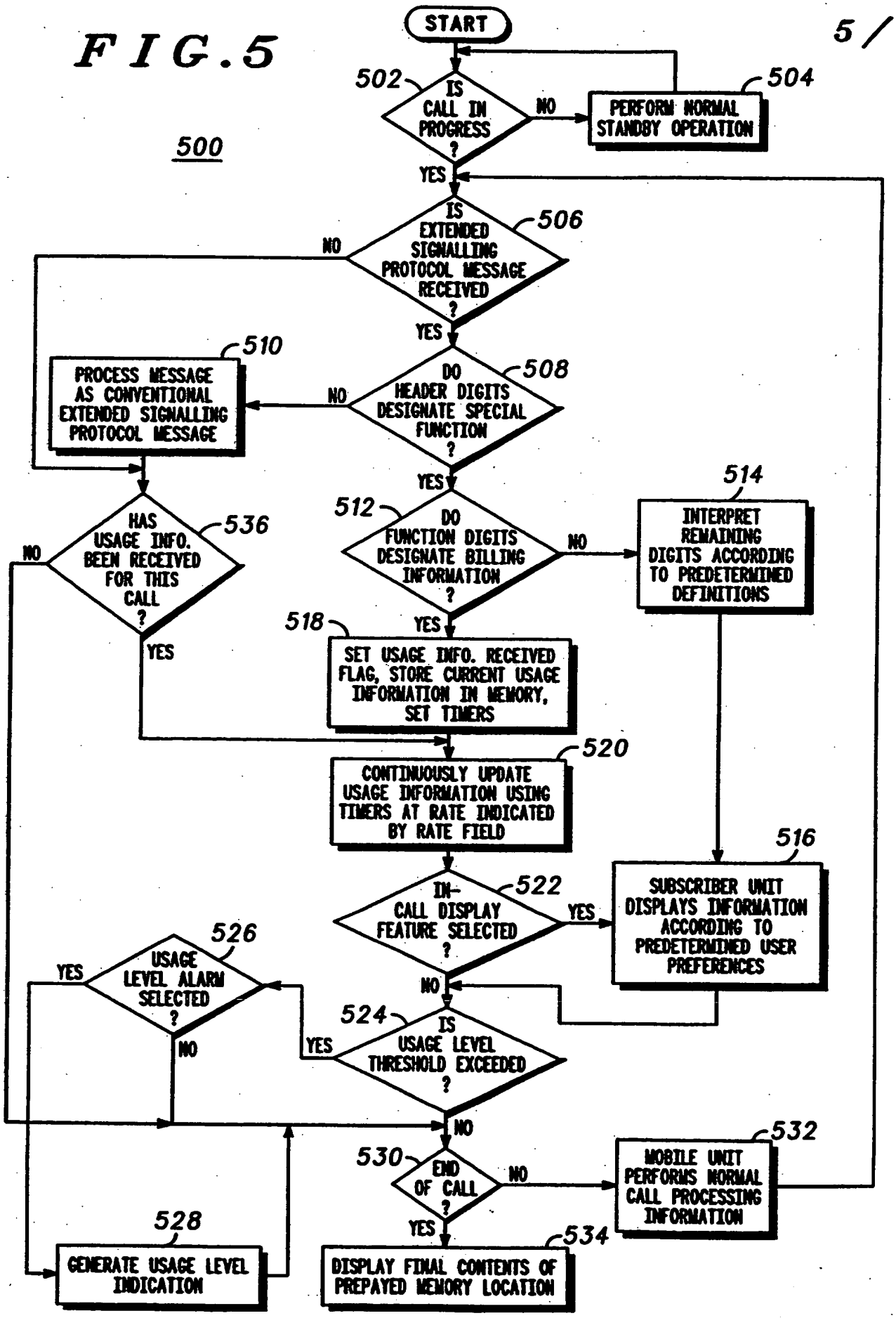


FIG.5



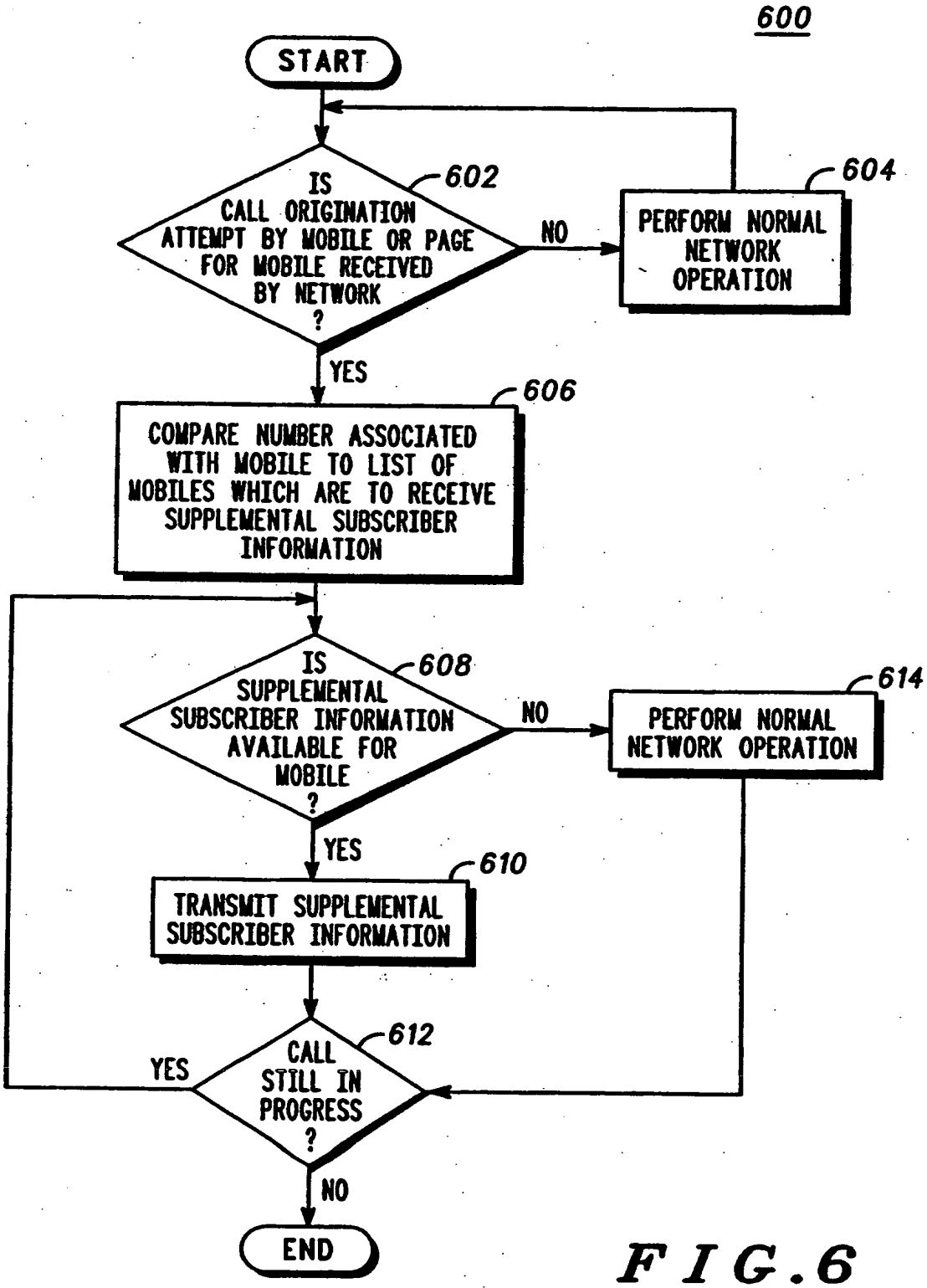


FIG.6

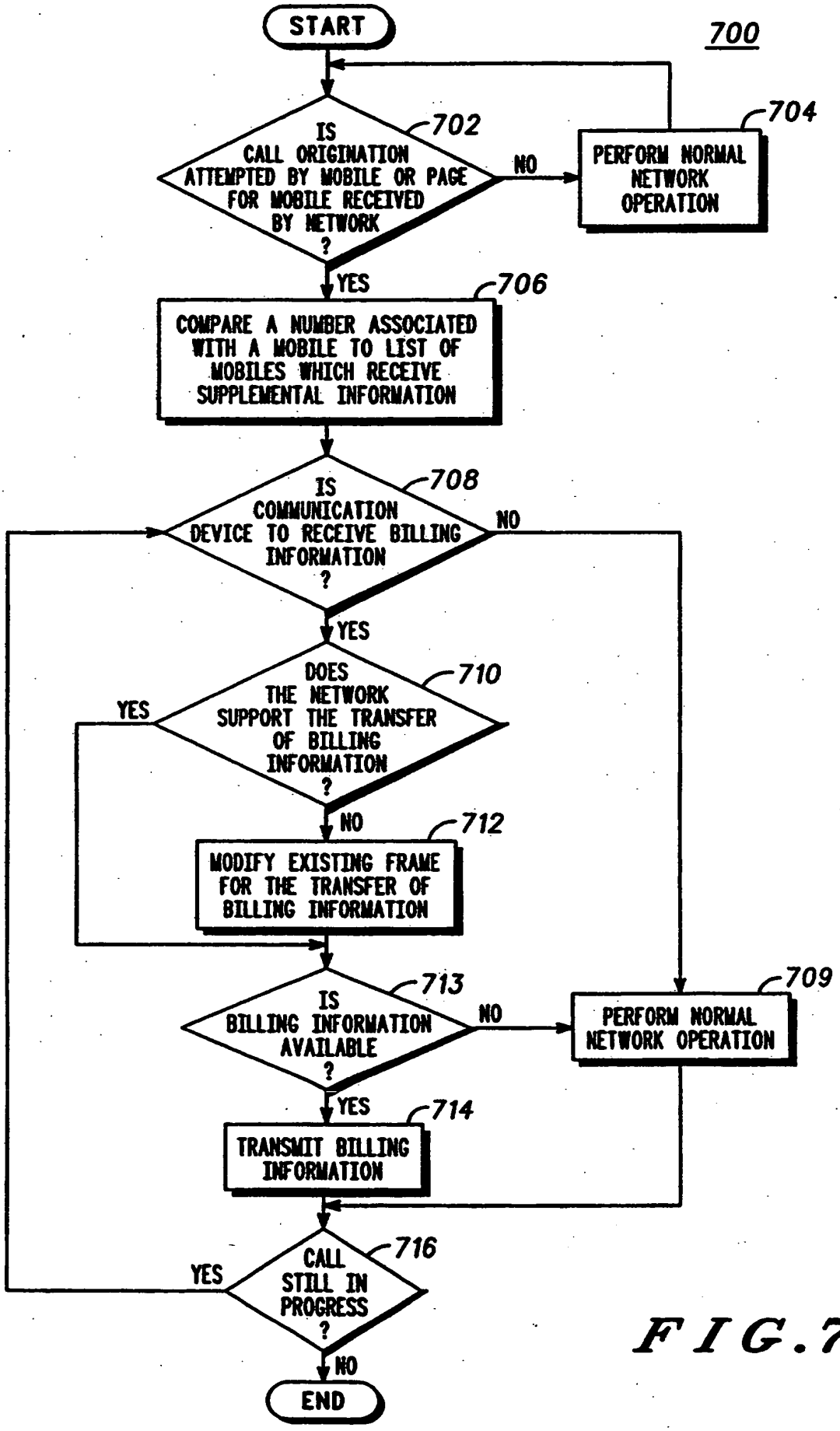


FIG.7

METHOD AND APPARATUS FOR TRANSMITTING INFORMATION

Field of the Invention

The present invention generally relates to communication devices, and more particularly to a method and apparatus for transmitting information to a subscriber of communication services.

Background of the Invention

Cellular telephones and other wireless communication devices have become increasingly popular in recent years. As the wireless communication systems have developed and more people have become subscribers of wireless communications services, the rates for service as well as the cost of subscriber equipment has decreased. Accordingly, wireless communications equipment and services have become available to a greater number of people.

However, service providers are concerned with subscribers who may be unable to pay for charges which they have incurred while using their communication device. Similarly, even with the decreasing costs of service, subscribers themselves are often concerned about exceeding their own budgets, such as a monthly budget allocated to telephone expenses. Because subscribers do not have any information regarding their current charges until the end of the month, it is not uncommon for subscribers to exceed their monthly budgets. To avoid such problems for both service providers and subscribers, many service providers have implemented

systems for pre-payment of services, such as pre-payment by use of a credit card. However, while such prepaid credit card service arrangements may prevent a service provider from covering charges which subscribers may not be able to afford, such arrangements do not enable a subscriber to regulate his or her usage of the service. That is, pre-paid credit card service arrangements do not provide any additional information regarding the amount of time of prepaid services remaining.

In response to concerns of subscribers, some service providers have enabled easy access to billing information. For example, a subscriber may call a toll-free number to receive billing information. Other providers of communication services have offered communication devices which provide a menu option to easily call the service provider. The service provider will download billing information to the communication device to be displayed at the device. However, such billing information is not provided in real time and does not provide a user with any indication as to the amount of services which he has used during a call or, in the case of pre-paid services, the amount of services which are remaining. Such information can be particularly significant if the billing rate for the call may be different.

Accordingly, there is a need for a method and apparatus for providing information during a call to a subscriber in real time, and more particularly for providing billing information to enable a subscriber to regulate his or her phone usage according to his or her individual needs. Also, there is a need for a method and apparatus for transferring such information while minimizing interruptions during the call.

Brief Description of the Drawings

FIG. 1 is a plan view of a communication network incorporating the present invention;

FIG. 2 is a block diagram of a communication device of FIG. 1 incorporating the present invention;

FIGs. 3A-3C are frame diagrams of frames for transmitting information, such as billing information, according to the present invention;

FIG. 4 is a flow chart showing steps for transmitting information according to the present invention;

FIG. 5 is a flow chart showing the transfer of billing information on an existing cellular network according to the present invention;

FIG. 6 is a flow chart showing a method for transferring information by a communication network; and

FIG. 7 is a flow chart showing the preferred steps of a method for transmitting billing information by a wireless communication network according to the present invention.

Detailed Description of the Invention

The present disclosure is related to transmitting information to a subscriber of communication services, and describes an apparatus and a communication network to provide such information. For example, the method and apparatus could provide the user of a communication device with real time information, such as billing information. The communication device preferably provides the subscriber with a "user-friendly" interface for use, for example, in a phone in a pre-paid system. The information can be stored in a predetermined memory location, and updated as necessary. In the case of billing information, the usage information can be updated by the communication device after initially receiving the billing information from the network in order to minimize changes to the network and the communication device itself and avoid creating a steady stream of messages which may interfere with the audio communication in the voice channel. The memory contents can be optionally displayed at a predetermined interval during a call, at the end of the call, or at any time at the user's command.

Turning now to FIG. 1, a wireless communication network 100 is shown. Wireless communication network 100 preferably includes a mobile switching center 102, a plurality of cell sites 104 each having a base station 105 coupled to a base site controllers 106. Finally, mobile communication devices 108, portable communications devices 110, or a fixed subscriber unit 112 (collectively "communication devices") are adapted to communicate with base stations associated with base site controllers 106 to maintain communications with another mobile unit or a wireline unit associated with a landline network. Fixed subscriber units

are adapted to transmit and receive RF communication signals and interface with a user by way of a conventional landline telephone device could also employ the present invention. Finally, a special function computer 114 coupled to or integrally associated with mobile switch center 102, performs the network operations for transmitting information according to FIGs. 8 and 9 of the present invention. Special function computer 114 could be incorporated in any other part of the network according to the present invention.

Turning now to FIG. 2, a block diagram shows a communication device 200 such as a cellular radiotelephone or other wireless communication device according to the present invention. In the preferred embodiment, an ASIC (Application Specific Integrated Circuit) 201, such as a CMOS ASIC available from Motorola, Inc. and control circuit 203, which could comprise a microprocessor, such as a 68HC11 microprocessor, also available from Motorola, Inc., combine to generate the necessary communication protocol for operating in the communication system. The control circuit 203 uses RAM 205, EEPROM 207, and ROM 209, consolidated in one package 211 in the preferred embodiment, to execute the steps necessary to generate the protocol and to perform other functions, such as writing to a display 213, accepting information from a keypad 215, and controlling a frequency synthesizer 225. The ASIC 201 processes audio transformed by the audio circuitry 219 from a microphone 217 and to a speaker 221. Transmitter 223 transmits through an antenna 229 using carrier frequencies produced by the frequency synthesizer 225. Information received by the communication device's antenna 229 enters the receiver 227 which demodulates the symbols comprising the message frame using the carrier frequencies from

the frequency synthesizer 225. The communication device may optionally include a message receiver and storage device including digital signal processing means. The message receiver and storage device could be, for example, a digital answering machine or a paging receiver. Finally, a timing circuit 231 as shown, or a discrete timing circuit, is employed to calculate and the amount of time in a call to update usage information, as will be described in more detail in reference to the remaining FIGs. While the circuitry of FIG. 2 shows an exemplary communication device, other circuitry could be employed within the scope of the present invention.

Turning now to FIG. 3, exemplary frame structures for transmitting information, such as billing information according to the present invention, are shown. As shown in FIG. 3-A, the first three digits, D1, D2, and D3, represent a header portion of the frame. As will be described in detail in reference to the remaining figures, the header could designate the type of message being sent. For example, the header could designate a conventional message sent according to a standard protocol for operating a cellular telephone. Alternatively, the header could designate a special function which is to be sent. The following digits D4 and D5 could represent, for example, function digits. If a special function header is sent, the function digits could designate what information will be sent in the following variable digits, D6-D10. The information sent in the variable digits could include subscriber specific information, or general information such as temperature, stock quotes, news briefings, or any other information, such as commercial or promotional information of the network or some third party.

As shown in FIG. 3-B, for function digits which represent billing information, the billing information could be sent as variable digits D6-

D10. Finally, according to an alternate embodiment shown in FIG. 3-C, if the function digits represent billing information, particular billing information such as calling units shown as digits D6-D8 and a billing rate D9-D10. The specific use of the calling units and the rate will be described in more detail in reference to the remaining figures. Although exemplary frame structures have been shown, other frame structures including different fields or numbers of digits per field could be used according to the present invention.

Turning now to FIG. 4, a flow chart shows a preferred embodiment for transmitting billing information on a communication network. At a step 402, the communication device determines whether a call is in progress. In a cellular radiotelephone system, for example, a call could be considered in progress when a voice channel is assigned. If a call is not in progress, the communication device performs normal standby operation at a step 404. However, if a call is in progress, the communication device determines whether the network supports sending billing information during a call at a step 406. If the network supports sending billing information, the communication device will process the billing information according to the established network protocol at a step 408.

If the network does not support sending billing information, the communication device determines whether there are any unused or unnecessary frames of a conventional signaling protocol available at a step 410. If the communication device is unable to receive billing information according to an established network protocol or by way of unused or unnecessary frames of an existing network protocol, the communication device performs normal call processing functions at a step 411. Preferably, if the communication device does not receive billing information within a

predetermined time period, the communication device will terminate the call.

If unused or unnecessary frames of a conventional signaling protocol are available on the network, the communication device determines whether a conventional signaling protocol message is received at a step 412. If a conventional signaling protocol message is received, the communication device determines whether the header digits designate a special function at a step 414. If the header digits designate a special function, the communication device determines whether the function digits designate billing information is being sent at a step 416. If the header digits do not designate a special function such as billing information, the communication device interprets the remaining digits according to a predetermined definition at a step 418. That is, if the header does not designate a special function, a conventional signaling protocol message, such as a caller line ID (CLI) message, will be interpreted. If special function digits are transmitted but do not designate billing information, the communication device will interpret the remaining digits according to an established definition. For example, if the function digits designate time, the remaining digits will represent the current time which could be displayed. If the function digits designate billing information at step 416, the communication device processes the billing information at a step 420.

The communication device then displays billing information according to predetermined preferences at a step 422. For example, the communication device can be preferably programmed to indicate the times during which the billing information should be displayed, such as periodically, or at the end of a call. Preferably, the billing information is calculated by the communication device during a call and may be

displayed at the beginning of a subsequent call. The communication device preferably maintains a memory location indicating the current usage, and then calculates the updated network usage information by receiving billing rate information from the network. For example, if the billing information includes a current billing balance and a billing rate, the communication device could calculate updated network usage information. If the subscriber is operating on a credit basis, then the communication device will subtract credit from the current credit according to the elapsed time of the call recorded by call timers in the communication device and the rate of the call as provided in the billing information (i.e. an initial update) from the network. Accordingly, the billing information can be calculated and maintained in the communication device, with minimal signaling requirements from the network.

Turning now to FIG. 5, a detailed flow diagram shows the preferred steps for calculating and displaying billing information in a communication device by receiving signals on an extended signaling protocol according to the present invention. In particular, the communication device determines whether a call is in progress at a step 502. If a call is not in progress, the communication device performs normal standby operation at a step 504. Among other standby functions, the communication device could display network usage information according to a user's preference. If a call is in progress, the communication device determines whether an extended signaling protocol message is received at a step 506. Once the phone call initiation is processed and charging is to begin, an "ADVISE OF CHARGE" message preferably will be sent by the network to the phone. Such a message could be an extended

protocol message, allowing the communication device to be used on any system, such as AMPS, NAMPS, TDMA, CDMA, GSM, etc., which supports the protocol message. The communication device will need the capability to receive and decode the extended protocol message.

According to one novel aspect of the invention, for example, a CLI message, which is defined in EIA/TIA Interim Standard IS-91 available from EIA Standard Sales Office, 2001 Pennsylvania Ave., N.W., Washington, D.C. 2006, normally can contain up to 32 digits of information. The message will contain preferably include a special sequence in the first digits (e.g. FFF), which will be an indication to the communication device to assign special meaning to the rest of the digits. In an AMPS system for example, each word normally contain 6 digits, which in NAMPS, each word contains 5 digits. Accordingly, only the first 10 digits are preferably used to make the definition system independent. The two-word CLI message preferably contains digits D1-D10 shown in FIG. 3. However, any other conventional message could be used.

If an extended signaling protocol message is received, the communication device then determines whether the header digits designate a special function at a step 508. If no special function is designated, the communication device processes the message as a conventional extended signaling protocol message at a step 510. For example, if the conventional extended signaling protocol message is a CLI message, the communication device would decode the message to determine the number of the incoming call. If the header digits designate a special function at step 508, the communication device determines whether the following function digits designate billing information being sent at step 512.

If the function digits do not designate billing information, the communication device interprets the remaining variable digits according to predetermined network definitions at a step 514. The communication device then displays information according to predetermined user preferences at a step 516. For example, the communication device could display time, temperature, or other information periodically. The information could be displayed at the beginning or end of a call, or in response to some condition or reaching some predetermined value, such as a preset time or temperature.

If the function digits designate billing information at step 512, the control circuit will set a usage information received flag and store current usage information received from the network in a predetermined location of the communication device, such as EEPROM 207, at a step 518. Also, a timer of the timing circuit 231 will be set in order to synchronize the communication device within the network. The usage information received flag is significant because usage information based upon information received from the network at the beginning of the call is preferably used. This enables the communication device to calculate the current usage information without having to continuously receive additional information on the voice channel during a call.

The control circuit 203 of the communication device will then update the network usage information at a rate indicated by the rate field at a step 520. Preferably, the control circuit continuously maintains the current usage information throughout the call based upon initial network usage information and the billing rate for the current call. That is, the communication device would calculate the elapsed time of the call by use of timing circuits 231. For a subscriber using a communication device in a

conventional manner and paying bills on a periodic basis, such as a monthly basis, the control circuit would calculate the debt incurred by the subscriber. In particular, the control circuit would multiply the number of minutes or calling units of the call by the calling rate provided by the network. The communication device could then determine the overall debt of the subscriber by adding the debt of the current call to the previous network usage debt. Alternatively, in an arrangement where the subscriber is applying the usage against a credit for service on the network, such as a prepaid amount applied to a credit card, the usage would be deducted from the credit.

The communication device would then determine whether an in-call display feature is selected at a step 522. If the feature is selected, the communication device would display the information according to the user's predetermined preferences at a step 516. If the in-call display feature is not selected or after displaying any information according to predetermined user preferences, the communication device would then determine whether a usage level threshold is exceeded at a step 524. If the threshold is exceeded, the communication device determines whether a usage level alarm is selected at a step 526. For example, a threshold could be a per call threshold, such as a ten minute level, or could be a threshold related to the overall debt or credit of the user.

If the usage level alarm is selected, the communication device will generate a low usage level indication at a step 528. The indication could be any type of indication which would alert the user that a threshold has been exceeded. The indication could be any audible indication or tactile indication, such as a vibrator. The communication device then determines whether a call has been ended at a step 530. If the call has not

been ended, the communication device performs normal call processing information at a step 532 and determines whether additional signaling protocol messages are received. If the call has ended, the communication device preferably displays the final contents of the memory location at a step 534.

Preferably, if usage information has not been received for a particular call at a step 536, the communication device will not display any billing information. Preferably, the communication device will not display any billing information if the usage information is not received at the beginning of the call. That is, any calculated billing information may be inaccurate if it is not received at the beginning of a call. Alternatively, the communication device could set a timer which could be used to determine the elapsed time so that the usage information could be accurately calculated. That is, the network would send usage information as of just prior to the call and the current call rate. The communication device would then apply the call rate to the elapsed time to calculate the current usage. Alternatively, the network could periodically send updated information, for example until an acknowledge is received, so that the communication device could calculate the continued usage from the time it receives the updated usage information. That is, the communication device would need only to calculate the usage information from the time it receives updated usage information from the network. Although the method for transmitting billing information finds particular application to mobile radiotelephone devices, such as a mobile cellular telephone, the method also applies to any communication device, such as a fixed subscriber unit.

According to one embodiment, multiple usage information messages could be sent by the network if the start of billing as determined by the network does not coincide with the start of the call (e.g. start of ringing). That is, the network could determine that the start of billing would begin when the call is answered, and not charge for the time that the phone was ringing. The first message could include for example "FFF" in digits D1-D3 indicating that billing information is being sent and digits FFF digits D8-D10 indicating that billing has not started. The network could then send a second message having the rate, such as "060" for sixty seconds per billing unit. The second message would be sent when the network starts billing, allowing the communication device to stay synchronized with the network. Also, the rate could include a code for a toll free call or a "calling party pays" call. Preferably, if the first message is not received within a predetermined period of time, the communication device will terminate the call. For example, if the first message should typically be received within one second, the communication device may terminate the call if it is not received within three seconds.

Turning now to FIG. 6, a flow chart shows the preferred steps for operating a wireless communication network according to the present invention. The network determines whether a call origination attempt by the communication device or a page for the communication device is received at a step 602. If the no call origination attempt or page for the communication device is received by the network, the network performs normal network operation at a step 604. However, if a call origination attempt or page is received, special function computer 114 of the network compares a identification number associated with the communication

device, such as a mobile identification number (MIN), to a list of numbers which are to receive supplemental subscriber information at a step 606.

If no supplemental information is available at step 608, the network performs normal network operation at step 609. If supplemental subscriber information is available for the communication device at a step 608, the network transmits the supplemental subscriber information according to a pre-determined protocol. The supplemental subscriber information could be, for example, billing information, time, temperature or other information related to the subscriber or otherwise. The system could then verify that, in the case of pre-paid services, the account has enough calling units to initiate a phone call, or in the case of conventional billing, the account has not exceeded some limit. In either case, the special function computer will look at the calling and called phone numbers to determine the calling rate. For example, if it is a local phone call, the rate could be 1 unit/minute. The network then determines whether a call is still in progress at a step 612. If the call is in progress, the network determines whether additional supplement subscriber information is available for the communication device at step 608. Otherwise, the call is terminated.

Turning now to FIG. 7, the steps for transmitting billing information according to an alternate embodiment of the invention is shown. At a step 702, the network determines whether a call origination attempt by the communication device or a page for the communication device is received by the network. If no call origination attempt or page is received, the network performs normal network operation at a step 704. Upon receiving a call origination or a page for the communication device, the network compares an identification number associated with the

communication device to a list of such numbers which are to receive billing information during a call at a step 706.

The network then determines whether the communication device is supposed to receive billing information at a step 708. If the communication device is not supposed to receive billing information, the network performs normal network operation at a step 709. However, if the communication device is to receive billing information, the network determines whether a signaling protocol of the network supports the transfer of billing information at a step 710.

If the network does not support the transfer of billing information, the network identifies an unused or unnecessary frame of an existing protocol. If such frames are available, the network generates a header portion of a frame to identify billing information which is being sent and the additional portions of the frame having billing information at a step 712. For example, the billing information could include a current billing balance for providing the current debt or credit of a user. Also, the billing information could include a rate for the current call to enable the communication device to calculate the actual usage during the call to keep the user's network usage updated. The network then determines whether additional information is available at a step 713, and transmits the additional information to the communication device at a step 714. Preferably, the information is sent on a voice channel to ensure that the communication device correctly calculates the billing for the call. However, the frame could be sent on a control channel. The network then determines whether a call is in progress at a step 716. If the call is still in progress, the network determines whether the communication device is to receive billing information at step 708. If the subscriber does not receive

billing information or no additional information is available, the network performs normal network operation at step 718.

Although the invention has been described and illustrated in the above description and drawings, it is understood that this description is by way of example only and that numerous changes and modifications can be made by those skilled in the art without departing from the true spirit and scope of the invention. For example, although the present invention finds particular application in portable cellular radiotelephones, the invention could be applied to any communication device, including pagers, electronic organizers, or computers. Applicant's invention should be limited only by the following claims.

We claim:

Claims

1. A communication device for processing network usage information during call, said communication device comprising:

a receiver to receive communication signals from a communication network, said communication signals having said network usage information;

a control circuit coupled to said receiver to decode said communication signals ; and

a timing circuit responsive to said control circuit to record an elapsed time in said call in response to said communication signals from said communication network.

2. The communication network according to claim 1 wherein said network usage information comprises a billing balance for said communication device and a current billing rate for said call.

3. The communication device according to claim 2 wherein said control circuit calculates current usage information.

4. The communication device according to claim 3 wherein said current usage information comprises a billing charge for said call.

5. A communication device for processing network usage information during a call, said communication device comprising:

a receiver to receive RF communication signals from a wireless communication network, said RF communication signals having a current billing balance for said communication device and a billing rate for said call; and

a control circuit coupled to said receiver to receive said RF communication signals, said control circuit comprising a timing circuit to record an elapsed time, wherein said control circuit calculates updated usage information cased upon said current billing balance, said billing rate and said elapsed time.

6. A method of processing network usage information during a call, said method comprising the steps of:

detecting said network usage information in communication signals from a communication network;

decoding said network usage information; and establishing a timer circuit to record a elapsed time in response to said network usage information.

7. The method of transmitting information of claim 11 wherein said step of decoding said network usage information comprises decoding a current billing rate for said call.

8. The method of transmitting information of claim 12 further including a step of calculating current usage information related to said call based upon said current billing rate and said elapsed time.

9. The method of transmitting information of claim 13 further comprising a step of calculating updated network usage information based upon said current billing balance and said current usage information.

10. A method of processing network usage information during a call, said method comprising the steps of:

detecting said network usage information in communication signals from a communication network;

decoding said network usage information to obtain a current billing balance for a communication device and a current billing rate for said call;

establishing a timer circuit to record an elapsed time in response to said network usage information;

calculating current usage information related to said call based upon said current billing information and said elapsed time;

calculating updated network usage information based upon said current billing balance and said current usage information.

The Patent Office

Application No:	GB 9801269.3	**Examiner:**	Nigel Hall
Claims searched:	1-6, 10	**Date of search:**	5 August 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): H4L (LDPP, LDTT, LECX); H4K (KEB)

Int Cl (Ed.6): H04Q 7/32, 7/22; H04M 15/28

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X,P	EP 0813332 A1	(NEC) See whole document	1,3-6,10
X	EP 0647055 A1	(AT&T) Seep4 line 47-p5 line 21	1-6,10
X	WO 95/20298 A1	(NOKIA) See p5 line 24-p6 line23	1,3-6,10
X	US 5400395	(BERENATO) See whole document	1,3-6,10
X	US 5109401	(HATTORI) See whole document	1,3-6,10

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.